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THE TREATMENT OF SNAKE-BITE IN AUSTRALIA.

(Reprinted from *The Medical Journal of Australia*,
17th October, 1931.)

First Aid Treatment.—First aid treatment varies with the site of the bite. If the bitten part be a limb, a ligature or ligatures should be applied within a few seconds after the bite. If the bite be upon a part where ligature is impossible, excision of a small area surrounding the fang punctures should be carried out without delay.

Ligature.—A ligature is of value only in retarding, while it is applied, the entry of venom into the circulating blood. In the instance of bites by brown snakes (*Demansia textilis*), the venom of which contains a powerful and diffusible coagulant, the ligature may prevent death by checking thrombosis. The ligature should be applied immediately, for the neurotoxins of all Australian snake venoms are rapidly diffusible.

The ligature should be sufficiently firmly applied to obstruct the arterial flow into the ligated part. It should be placed round a part of a limb containing only a single bone. Ligatures round the wrist, forearm, ankle, and calf are valueless, since deeply seated vessels lying between two bones cannot be obstructed. Under these circumstances the ligated part becomes very swollen and the venom leaks steadily into the circulation while the ligature is still in position. In every case of a bite upon a limb a ligature must be applied upon either the thigh or the arm above the elbow joint.

The properly applied ligature gives time for local treatment to be carried out and slows down the entry of venom during the time which elapses before antivenene can be administered.

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The ligature may be left in position for half an hour, after which time it should be lifted for at least a minute or until the ligated part becomes pink with the entry of blood, then the ligature is reapplied at once. This procedure should be carried out every quarter of an hour to avoid serious damage to the tissues by prolonged local anoxæmia. Under these conditions a ligature may be safely used for one to two hours, when it is probably wise to discard it altogether.

In bites by tiger snakes the ligature should be removed as soon as antivenene has been injected, but if antivenene is not available early, it should be given as soon as possible after the ligature has been removed.

Excision.—Excision should be carried out immediately after a bite upon an area where a ligature cannot be applied. N. Hamilton Fairley advises excision of the skin and subcutaneous tissue over an area, including the punctures, a little greater than a square inch. The excision should be extensive enough to include the deepest point reached by the fangs.

Excision is of no value whatever unless carried out at once and is therefore seldom made. The surface should, if possible, be washed or licked to remove venom on the surface of the skin before excision. It is of value to apply suction either by the mouth or by a dry cup immediately afterwards. The surface of the excision and the surrounding skin may with advantage be washed with weak potassium permanganate solution if this substance is available.

If the bite be upon an area above which ligatures can be applied, excision of the area including the fang marks is still the best treatment if applied immediately.

Incision.—Incision is not a very satisfactory method. Theoretically the incisions should be made along the tracks of the fang punctures, starting from the punctures and being roughly at right angles to a line joining them. As the tracks are directed somewhat obliquely backwards and inwards, and it is often uncertain exactly how the snake gripped the part, it is better to make two nearly parallel incisions through the region of each puncture, starting in front of the line joining the marks and extending behind it. Blood should be squeezed

through the incisions out of the ligated part by bandaging it firmly from the ligature downwards. Persons applying first aid to themselves will frequently use this method, as it requires great physical courage to perform excision.

Local Venesection.—Local venesection may be carried out in snake-bites on the limbs if the patient is seen by a medical man within the first hour or two and the ligature has not yet been removed. In principle it depends upon washing out the part with the patient's own blood. A second ligature, theoretically tight enough to obstruct the venous return, but not the arterial flow into the limb, is placed in position immediately distal to the arterial ligature. An incision is made into one of the veins draining the area in which the bite is situated, and a succession of small blood lettings from this vein are carried out by lifting the arterial ligature for a minute or two and leaving the venous ligature in position. Some venom (in animal experiments about a third to a half of the amount injected) can be removed in this way, and the treatment is useful if antivenene is not available. In a child the blood can be replaced by transfusion from a suitable donor. In an adult a pint or a pint and a half of blood can be removed in flushing the bitten part in this way.

Antivenene.—Antivenene is as yet available for use only against the bites of the tiger snake (*Notechis scutatus*) and is not of practical use against the venoms of other species. It is put up in ampoules containing approximately 30 cubic centimetres, or 1,500 units, an amount sufficient to neutralize 15 milligrammes of dry tiger snake venom in vitro. It should be administered intravenously in a dose of 3,000 units. More should be given if further symptoms develop after its administration. Intravenous injection is of value because, as Martin pointed out, it rapidly neutralizes venom which is already circulating in the blood. **The earlier the antivenene can be administered, the better the chances of recovery.** Even to those patients who are brought for treatment late, that is, more than twelve hours after being bitten, large doses of antivenene should be given. In a recent case of tiger snake bite the patient was admitted with serious

symptoms 24 hours after being bitten ; the administration of 4,500 units of antivenene intravenously and a further 3,000 units intramuscularly (to maintain a high concentration of antivenene in the blood) was followed by a dramatic recovery.

Therefore, one should not despair of any victim of tiger snake bite, but should begin treatment with antivenene as soon as possible.

The subcutaneous administration of antivenene is of little value, since the absorption rate of serum is so much slower than that of the rapidly diffusible snake poisons.

A number of persons are hypersensitive to horse serum, and in such cases rapid intravenous injections of serum may cause acute anaphylactic shock. There may or may not be a history to guide one of attacks of asthma or hay fever, or of having received previous injections of serum. Horse asthmatics are particularly prone to react dangerously following the injection of horse serum. It is much safer, therefore, to test the patient before giving an intravenous dose by injecting intradermally 0·1 cubic centimetre of diluted horse serum. This may be prepared rapidly by adding one part of serum to nine parts of sterile normal saline solution, mixing well, and injecting one-tenth of a cubic centimetre of the diluted serum into the skin.

A control injection is made of 0·1 cubic centimetre of normal saline solution prior to giving the diluted serum. Wheals are produced at the site of injection in both cases ; that produced by the salt solution disappears in the course of a few minutes. If the patient is not hypersensitive, the wheal produced by the serum fades almost as quickly. If a positive result to the test is obtained, a genuine urticarial wheal appears which may increase in size and be surrounded by an area of erythema. Itching frequently accompanies a positive reaction.

It should be possible to determine within twenty minutes of the injection what type of reaction the patient will give.

Should the patient prove hypersensitive to serum, it is dangerous to give serum intravenously without first desensitizing the patient. To do this, an initial dose of 0·025

cubic centimetre is given subcutaneously. If noticeable symptoms due to serum do not appear, half an hour later give 0·1 cubic centimetre of the serum subcutaneously and await results. If appearances are still favorable, then in half an hour give 1·0 cubic centimetre of serum subcutaneously. This is a much more rapid method of desensitizing than that usually recommended, of commencing with 0·025 cubic centimetre and doubling the dose at half-hourly intervals until 1·0 cubic centimetre has been given subcutaneously.

However, it must be remembered that it is necessary to act quickly in giving serum in a case of snake-bite.

Provided that no symptoms develop as a result of giving the third dose of serum, it is justifiable to proceed with the serum treatment without further delay.

As an initial intravenous injection give 0·1 cubic centimetre of serum. If no symptoms develop, proceed very carefully with the remainder of the serum. It should be given very slowly, and if unfavorable symptoms develop, administration should be interrupted for the time being.

For the prevention of serum anaphylactic shock in man, one may give 1·3 milligrammes (one-fiftieth of a grain) of atropine sulphate by subcutaneous injection about half an hour before giving serum intravenously.

For the treatment of anaphylactic shock, adrenalin chloride, in a dose of 0·5 to 1·0 cubic centimetre of one in 1,000 dilution should be kept in readiness and given if necessary.

Should the case be desperate and time of the utmost importance, the possible risk of causing serious anaphylactic symptoms should be disregarded and energetic treatment by intravenous and intramuscular injection should be begun without delay.

General Treatment.—The patient should be made to rest. He should not walk about, for the increased circulatory rate induced by exercise will speed up absorption of the poison. Furthermore, rest is desirable on general grounds, and no additional stress should be inflicted on the nervous system.

Alcohol is undesirable except for those accustomed to its use, and even then should be given only in small amounts. The best beverage as a stimulant is hot black coffee. Strychnine is of doubtful utility and in large and repeated doses may be dangerous to the patient. Pituitrin is possibly of value.

Circulatory shock should be combated by keeping the patient warm and giving plenty of fluid.

The supreme danger is that of respiratory failure, and the use of morphine is, therefore, contraindicated.

Finally, it is of the first importance that the patient should not be allowed to become the victim of his own fears.

The great majority of snake-bitten persons should recover if adequate treatment is adopted. In cases of bites by the tiger snake, the mortality, if antivenene is used, should be negligible. Otherwise the death adder is the only snake the bite of which is still likely to be attended by a substantial mortality. Treatment of bites by this snake should be energetic. If the patient be seen immediately after the bite, excision of the bitten area should be performed. If the first few minutes have passed, but the patient be seen within two hours of the bite, treatment by local venesection should, if possible, be performed, provided that a ligature has been previously applied.

Supplies are available in phials containing 1,500 units, and may be obtained from the Commonwealth Serum Laboratories, Parkville, N.2, Victoria, or from the undermentioned :—

FEDERAL CAPITAL TERRITORY.

Director-General of Health, Canberra.

NEW SOUTH WALES.

Chief Quarantine Officer (General), Customs House, Circular Quay, Sydney.

Medical Officer-in-Charge, Health Laboratory, Lismore.

VICTORIA.

Medical Officer-in-Charge, Health Laboratory, Bendigo.

QUEENSLAND.

Chief Quarantine Officer (General), Steamship Chambers, Eagle-street, Brisbane.

Medical Officer-in-Charge, Health Laboratory, Toowoomba.

Medical Officer-in-Charge, Health Laboratory, Rockhampton.

Medical Officer-in-Charge, Health Laboratory, Cairns.

Medical Officer-in-Charge, Health Laboratory, Townsville.

SOUTH AUSTRALIA.

Chief Quarantine Officer (General), Peel Chambers, Peel-street, Adelaide.

Medical Officer-in-Charge, Health Laboratory, Port Pirie.

WESTERN AUSTRALIA.

Chief Quarantine Officer (General), 4th Floor, G.P.O., Perth.

Medical Officer-in-Charge, Health Laboratory, Kalgoorlie.

TASMANIA.

Chief Quarantine Officer (General), Commonwealth Health Laboratory, Launceston.

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